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November 15, 2013

Dania Zinner
USEPA; Region 8
1595 Wynkoop Street (8EPR-SR)
Denver, CO 80202-1129

Document ID #: 3019-11152013-1

Dear Ms. Zinner:

EPA CONTRACT NUMBER EP-W-10-033
TASK ORDER NUMBER 3019
QA SUPPORT FOR THE LIBBY ASBESTOS SITE

Enclosed please find the Summary Asbestos On-site Audit Report for the on-site audit performed on May 9, 2013 at Reservoirs Environmental, Inc. in Denver, Colorado. This report and the accompanying checklist are deliverables under Task 5 of the subject Task Order.

If you have any questions, please feel free to contact me.

Sincerely,

Timothy L. Vonnahme
Audit Group Manager, QATS Program
CB&I Federal Services, LLC
Phone: (702) 895-8729
E-Mail Address: timothy.vonnahme@cbifederalservices.com

cc: Administrative Contracting Officer (letter only)
Audit Group Files

REPORT

FOR

TASK ORDER NUMBER 2019
QUALITY ASSURANCE SUPPORT FOR THE LIBBY ASBESTOS SITE

SUMMARY ASBESTOS ON-SITE AUDIT REPORT

Reservoirs Environmental, Inc. (Denver, Colorado)

Prepared by:

The Data Auditing Group
Quality Assurance Technical Support Program
CB&I Federal Services, LLC
2700 Chandler Avenue
Las Vegas, Nevada 89120

November 14, 2013

QATS Contract Number: EP-W-10-033

Prepared for:

Dania Zinner
Task Order Manager

Region 8
U.S. Environmental Protection Agency
1595 Wynkoop Street
Denver, CO 80202

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LABORATORY INFORMATION AND AUDIT SCOPE

This report summarizes the results of an asbestos on-site laboratory audit of Reservoirs Environmental, Inc. in Denver, Colorado performed on May 9, 2013. The audit was conducted in support of the United States Environmental Protection Agency (EPA) Region 8 Libby Superfund Site activities. The purpose of the audit was to evaluate corrective actions taken by the laboratory to address deficiencies identified from the last on-site audit conducted on September 12-13, 2012. CB&I Federal Services, LLC Quality Assurance Technical Support (QATS) staff participation in the on-site audit and subsequent preparation of this report was performed under Task 5, Task Order 2019, QATS Contract EP-W-10-033.

Detailed information regarding the subject laboratory is as follows:

Date of On-site:	**May 9, 2013**
Laboratory:	**Reservoirs Environmental, Inc.** **5801 Logan Street** **Denver, CO 80216** **(303) 964-1986**
President:	**Jeanne Spencer**
Audit Team	
US EPA:	**Dania Zinner (by teleconference)**
CB&I QATS:	**Michael Lenkauskas, CQA, Senior Auditor**

The Audit Team, comprised of CB&I Federal Services, LLC QATS personnel, performed the technical and evidentiary aspects of the on-site audit. Due to unforeseen circumstances, a representative of the EPA was not able to attend but participated in the debriefing via conference call. The technical and evidentiary parts of the audit involved an evaluation of the corrective actions taken by the laboratory to address the deficiencies identified during the previous on-site audit conducted September 12-13, 2012.

The processes evaluated included direct and indirect sample preparation for Transmission Electron Microscopy (TEM) analysis; analysis by Polarized Light Microscopy (PLM); Data Management; Quality Control; and Quality Assurance (QA/QC). All pertinent laboratory instrumentation and equipment were inspected for proper maintenance and calibration, and laboratory personnel were interviewed to determine their understanding and adherence to laboratory procedures.

During the course of the audit, the applicable sections of the Libby-Specific Asbestos Laboratory On-site Audit Checklist were completed by the Audit Team. Sections of the checklist not completed during the audit are indicated with an “NA.” The checklist is provided as an attachment to this report (EPA only).

EXECUTIVE SUMMARY

An asbestos on-site audit of Reservoirs Environmental, Inc. in Denver, Colorado was performed on May 9, 2013 in support of EPA Region 8 Libby Superfund Site activities. The primary focus of the audit was to evaluate corrective actions taken by the laboratory to address deficiencies identified during the previous on-site audit conducted on September 12-13, 2012. The laboratory areas and processes evaluated included direct and indirect sample preparation for TEM analysis, analysis by PLM, Data Management, and QA/QC.

The corrective action applied by the laboratory to the six deficiencies identified in the September 2012 on-site audit were evaluated during the current on-site audit. The Audit Team determined that the laboratory had completely addressed all six, for a corrective action rate of 100%.

The on-site audit identified one deficiency, which is summarized below by laboratory area:

Indirect and Direct Preparation of Air Filter and Dust Samples – One deficiency was assessed for failure to prepare two sets of tree bark samples and two sets of duff samples received by the laboratory in October 2012 as specified in the applicable project-specific SOPs.

With the exception of the deficiency noted above, the on-site evaluation revealed Reservoirs Environmental, Inc. to have sufficient facilities, equipment, and staff to analyze samples in accordance with the Libby-specific protocols. All staff and management were cooperative, readily answered all questions asked by the Audit Team, and appeared to be responsive to the identified deficiency.

AUDIT FINDINGS

Sample Receipt, Login and Chain-of-Custody

This area was not evaluated since there were no sample receipt, login, or chain-of-custody issues identified during the previous audit.

Indirect and Direct Preparation of Air Filter and Dust Samples

The evaluation of this area focused on two deficiencies identified in the previous audit. These deficiencies have been addressed as described in the section "Corrective Action Applied from the Previous Audit Deficiencies" on Page 6 of this report. One new deficiency was identified:

1. Two sets of tree bark samples and two sets of duff samples received by the laboratory in October 2012 were not prepared as specified in the applicable project-specific SOPs.

    - The two tree bark sample sets each consisted of three core samples contained in a single bag. There were multiple core samples; however, only one core was selected at random, ashed, prepared, and analyzed by TEM. The remaining cores were not analyzed and archived without ashing.

    - The duff samples, due to their size, were split into separate aliquots for ashing; however, only one of the aliquots was ashed, prepared, and analyzed by TEM. The remaining sample aliquots were not analyzed and archived without ashing.

    The requirements to "add the entire tree bark core to the Crucible" for ashing and to combine duff ash samples "if ashed in more than one pan" are described in Section 6.1 of the Sampling and Analysis of Tree Bark for Asbestos (EPA-Libby-2012-12) and Section 6.1 of the Sampling and Analysis of Duff for Asbestos (EPA-Libby-2012-11), respectively. (Checklist Nos. 6.11.2.4 and 6.14.1)

    Recommended Corrective Action – Although the above deficiencies were addressed in a temporary laboratory-specific modification (LB-000092), the issuance of written corrective action to ensure against future deviations from project-specific SOPs is necessary.

Transmission Electron Microscopy (PLM) Analysis

This area was not evaluated since there were no PLM issues identified during the previous audit.

Polarized Light Microscopy (PLM) Analysis

The evaluation of this area focused on the two deficiencies identified in the previous on-site audit, both of which were found to have been adequately addressed. No additional deficiencies were observed.

Data Management

The evaluation of this area focused on one deficiency identified in the previous on-site audit, which was found to have been adequately addressed. No additional deficiencies were observed.

Quality Control and Quality Assurance (QA/QC)

The evaluation of this area focused on one deficiency identified in the previous on-site audit, which was found to have been adequately addressed. No additional deficiencies were observed.

CORRECTIVE ACTION APPLIED FROM THE PREVIOUS AUDIT FINDINGS

The on-site laboratory evaluation included an assessment of the six deficiencies identified and reported in the previous on-site audit performed on September 12-13, 2012. The Audit Team determined that the laboratory had completely addressed all six deficiencies resulting in a corrective action rate of 100%. The following are the deficiencies identified from the previous on-site audit, the laboratory's verbatim responses to the audit comments, and effectiveness checks performed during the current on-site audit.

Sample Receipt, Storage, Log-in, and Chain-of-Custody (COC)

No deficiencies concerning sample receipt, storage, log-in, and COC were identified.

Indirect and Direct Preparation of Air Filter and Dust Samples

1. Although the interviewee indicated that the face velocity of the High-Efficiency Particulate Air (HEPA) hood, which is utilized to prepare samples for TEM analysis, is checked on a quarterly basis, there is no documented evidence that the checks are actually performed. The requirement that hood ventilation velocities are measured on a quarterly basis and recorded in the equipment logbook is described in Section VI. F of the laboratory's QAM. (Checklist Nos. 6.4.1.1 and 6.15.1)

   Recommended Corrective Action – Ensure that hood face velocities are checked on a quarterly basis and that all checks are documented in the equipment logbook.

   Laboratory Response (12/07/2012): *The Air Filtronics HEPA hood has been added to the Quarterly Maintenance Log. A copy of the log is attached as documentation.*

   Effectiveness Check (05/09/2013): This deficiency has been completely addressed.

2. The Effective Filtration Area (EFA) of the disposable filter assemblies used for indirect sample preparation are not determined for each lot of filters received but assumed by the laboratory to be consistent. (Checklist No. 6.4.7.2)

   Recommended Corrective Action – Ensure that the EFA of disposable and reusable filtration assemblies are determined and that the EFA of disposable filter assemblies are determined for each lot received.

   Laboratory Response (12/07/2012): *The measurement of the effective filter area is now measured for each lot of disposable filter assemblies prior to their use in the laboratory. A copy of the record is attached as documentation*.

   Effectiveness Check (05/09/2013): This deficiency has been completely addressed.

Transmission Electron Microscopy (TEM) Analysis

No deficiencies concerning TEM analysis were identified.

Polarized Light Microscopy (PLM) Analysis

3. The laboratory is not currently performing the PLM analysis of fine ground soil samples as described in the Libby-specific SOP. SOP SRC-Libby-03 (rev. 3) requires that the entire sample be examined, suspect fibers be picked out prior to preparing five random slide mounts, samples be mounted in an RI liquid of between 1.620 and 1.640, and that each sample be agitated and reexamined for fiber picks. The procedure demonstrated by the analyst involved a less than thorough examination of the entire sample followed by the preparation of five random slide mounts in RI liquid 1.605, which were analyzed by PLM. The analyst did not perform the initial or supplemental fiber pick procedures nor mount the sample in the specified RI liquid (1.620 – 1.640). The requirement that the laboratory supervisor ensure that all analyses are performed in accordance with the SOP and that the laboratory supervisor identify and take appropriate corrective action to address any deviations is described in Section 3.1 of the Libby-specific SOP for the Analysis of Fibers in Soil by PLM (SRC-Libby-03, Rev. 3). (Checklist Nos. 8.11.1.3, 8.11.1.4, 8.11.3.1, 8.11.4.1, 8.11.4.2, and 8.14.1)

   Recommended Corrective Action – Ensure that all analyses are performed in strict accordance with the procedures described in the Libby-specific SOPs for the Analysis of asbestos fibers in Soil by PLM.

   Laboratory Response (12/07/2012): *The laboratory has performed the PLM-VE analysis strictly according to the Libby Specific SOP on all samples analyzed for the Libby Asbestos Investigation. The laboratory understands the analyst did not portray this adherence to the SOP during the audit, as his mind was clearly elsewhere. This analyst is extremely capable and dedicated to following procedures and prescribed methodology. The Libby Specific SOP shall be reviewed with each analyst as the Laboratory receives project specific samples. The analyst shall have a copy of Section 13.1 through 13.4 at their work station for a step by step reference as samples are being analyzed. Furthermore, 1.625 RI liquid has been added so that the analyst is able to mount the soil preparations in an RI liquid other than 1.620, as stated by the method. The laboratory supervisor shall oversea the analysis to insure the strict adherence to SRC-Libby-03.*

   Effectiveness Check (05/09/2013): This deficiency has been completely addressed.

4. The Laboratory Duplicate Cross-check (LDC) analytical observations (i.e., optical properties) are currently recorded on the same bench sheet as the analytical observations of the original (first) analysis, and are therefore not “blind.” The requirement that original results be redacted prior to transferring the PLM bench sheet to the recount analyst is described in Section I.A1. (PLM Reanalysis) of the laboratory’s PLM SOP. (Checklist No. 8.13.1.2)

   Recommended Corrective Action – Ensure that LDC results are recorded on a separate bench sheet other than that used to record the original results and that the results from the original (first) analyses are not known to the individual performing the second QC analysis.

   Laboratory Response (12/07/2012): *The laboratory will record LCD results on a separate bench sheet.*

   Effectiveness Check (05/09/2013): This deficiency has been completely addressed.

Data Management

5. The delivery date of hard copy and electronic TEM deliverables, which are currently provided on DVD, are neither tracked nor recorded. In order to determine the timely submittal of deliverables by the laboratory, track deliverables lost or misplaced by the courier, or determine whether or not the deliverable was submitted to the appropriate recipient, it is important to document how, when, and to whom deliverables are delivered. (Checklist Nos. 9.2.1 and 9.2.2)

   Recommended Corrective Action – Develop a tracking mechanism to help retrieve deliverables should they become lost, that includes the recipient, courier used, and the date the deliverables are shipped.

   Laboratory Response (12/07/2012): *The laboratory will record the delivery date and method of delivery on the original chain of custody. The laboratory will also continue to archive email correspondence.*

   Effectiveness Check (05/09/2013): This deficiency has been completely addressed.

Quality Control and Quality Assurance

6. Although the laboratory's corrective action report (CAR) process appears to be operational in most respects, the CAR spreadsheet does not include the date that the corrective action was implemented or a scheduled date to determine its effectiveness. In addition, CARs are not currently initiated for deficiencies identified during internal audits. The requirements for assigning, initiating, and performing effectiveness checks for corrective actions are described in Section VIII.G of the laboratories QAM. (Checklist No. 10.4.1)

   Recommended Corrective Action – In order to more effectively monitor the area of work affected by a deficiency or departure from procedure resulting in a CAR, track the dates on which each corrective action is implemented and effectiveness (follow-up) will be assessed.

   Laboratory Response (12/07/2012): *A column has been added to the corrective action spreadsheet to track when the corrective action was completed. A copy of the spreadsheet is attached as documentation.*

   Effectiveness Check (05/09/2013): This deficiency has been completely addressed.

CONCLUSIONS

An asbestos on-site audit of Reservoirs Environmental, Inc. in Denver, Colorado was performed on May 9, 2013 in support of EPA Region 8 Libby Superfund Site activities. The primary focus of the audit involved an evaluation of the corrective actions taken by the laboratory to address deficiencies identified during the previous on-site audit conducted on September 12-13, 2012. The laboratory areas evaluated and processed included direct and indirect sample preparation for TEM analysis, analysis by PLM, Data Management, and QA/QC.

The Audit Team evaluated the corrective action applied to the six deficiencies identified in the previous on-site audit, and determined that the laboratory completely addressed all six, or a corrective action rate of 100%.

The on-site audit identified the following deficiency:

- Two sets of tree bark samples and two sets of duff samples received by the laboratory in October 2012 were not prepared as specified in the applicable project-specific SOPs.

With the exception of the one deficiency noted in the report, the on-site evaluation revealed Reservoirs Environmental, Inc. to have sufficient facilities, equipment, and staff to analyze samples in accordance with the specified methodologies and Libby-specific protocol. All staff and management were cooperative, readily answered all questions asked by the Audit Team, and appeared to be responsive to the identified deficiency.

ATTACHMENT

Libby-Specific Asbestos Laboratory On-site Audit Checklist (EPA Only)

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

Laboratory: Reservoirs Environmental, Inc.

Address: 5801 Logan Street

Denver, CO 80216

Telephone: (303) 964-1986

Laboratory Personnel Contacted

Name	Title
Jeanne Spencer	President
Robin Klover	Vice President/QAO
Paul LoScalzo	Vice President/PLM Manager
Nicole Mera	Sample Custodian
Matt Preston	TEM Preparation Technician
Wenlong Lia	PLM Analyst

Evaluation Team

Name	Title
Michael Lenkauskas, CQA	CB&I Federal Services, LLC (QATS), Senior Auditor

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

1.0 LABORATORY STATUS & CAPABILITIES	Yes	No	Comments
1.1 Which of the following capabilities does the laboratory possess:			
1.1.1 Phase Contrast Microscopy (PCM)?	☒	☐	
1.1.2 Polarized Light Microscopy (PLM)?	☒	☐	
1.1.3 Transmission Electron Microscopy (TEM)?	☒	☐	
1.1.4 Others (list)?	☐	☒	
1.2 Is the laboratory currently receiving samples from Libby Superfund Site Operable Units?	☒	☐	

If "**YES,**" complete the following table:

Operable Unit	Matrix/Method(s)	Project/Comments
All	Soil/PLM-VE & Grav	
All	Air/TEM ISO 10312 & AHERA	
All	Tree Bark & Duff/ISO 10312	

2.0 LABORATORY SECURITY	Yes	No	Comments
2.1 Are visitors required to sign in?	☒	☐	
2.2 Are all entrances to the laboratory secured?	☒	☐	

Additional Comments:

3.0 PROJECT INITIATION/PROJECT MANAGEMENT	Yes	No	Comments
3.1 Are there designated project managers or a project management team to ensure samples received are properly processed?	☒	☐	Jeanne Spencer
3.2 Are project-specific requirements and procedures communicated to laboratory staff:			
3.2.1 Project-specific SOPs?	☒	☐	Available in eRoom
3.2.2 Laboratory Modifications?	☒	☐	
3.2.3 SAP Analytical Summaries?	☒	☐	
3.2.4 Project-specific Electronic Data Deliverables (EDDs)?	☒	☐	
3.2.5 Other (list)?	☐	☒	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

4.0 SAMPLE RECEIPT, LOG-IN, STORAGE, & TRACKING	Yes	No	Comments
4.1 Is the sample receiving area adequate, clean, and orderly?	NA	NA	

Personnel Interviewed

Name	Title	Experience
Nicole Mera	Sample Custodian	4 Years

4.2 Sample Receipt			
4.2.1 Is there a sample custodian and designated alternate responsible for sample receipt and log-in?	NA	NA	
4.2.2 Is the custodian or alternate available to receive and log-in samples at any time delivery services are operating?	NA	NA	
4.2.3 Are sample shipping containers opened in a HEPA hood (as necessary) to both minimize personal exposure and safeguard against laboratory contamination?	NA	NA	
4.2.4 Does the sample custodian verify and record the following when inspecting shipments and reviewing documentation:			
4.2.4.1 Presence and condition of custody seals?	NA	NA	
4.2.4.2 Presence or absence of Chain-of-Custody (COC) records?	NA	NA	
4.2.4.3 Presence or absence of air bill sticker(s)?	NA	NA	
4.2.4.4 Sample condition?	NA	NA	
4.2.4.5 Presence of packaging or packing material which could compromise samples (i.e., vermiculite & polystyrene)?	NA	NA	
4.2.4.6 Problems/discrepancies between samples, documentation, client requests, etc.?	NA	NA	
4.2.4.7 Bulk and air samples received separately?	NA	NA	
4.2.5 Are COC records signed and dated at the time of sample receipt?	NA	NA	
4.2.6 Is a system in place to ensure laboratory personnel are made aware of project specific requirements?	NA	NA	
4.2.7 Is a system in place to contact the client in case of absent documentation, or discrepancies between COCs, client requests, etc.?	NA	NA	
4.2.8 Are subsequent resolutions to problems and discrepancies documented?	NA	NA	
4.3 Sample Identification			
4.3.1 Are sample receipt identification logbooks, or a LIMS, used to log-in samples and assign unique laboratory identification numbers?	NA	NA	New LIMS
4.3.1.1 Does the logbook or logging system serve as a direct cross-reference between laboratory ID numbers and client ID numbers?	N/A	N/A	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

4.0 SAMPLE RECEIPT, LOG-IN, STORAGE, & TRACKING	Yes	No	Comments
4.4 Sample Storage			
4.4.1 Are storage facilities sufficient?	NA	NA	
4.4.2 Is the sample storage area secured to prevent entry of unauthorized personnel?	NA	NA	
4.4.3 Is a logbook or other means used to record sample locations?	NA	NA	
4.4.4 Are samples easy to locate from logbook references?	NA	NA	
4.5 Sample Tracking			
4.5.1 Is a system in place to keep track of samples entering and leaving the storage, sample preparation, and analysis areas?	NA	NA	
4.5.2 Are the retention and/or disposal of unused portions of samples and prepared samples documented?	NA	NA	
4.5.2.1 Are project-specific retention and/or disposal requirements communicated and followed?	NA	NA	
4.6 Standard Operating Procedures (SOPs)			
4.6.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	NA	NA	

Document Title	Control No.	Description

4.7 Document Control:	Yes	No	Comments
4.7.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	NA	NA	

Document Title	Description/Comments

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

5.0 PHASE CONTRAST MICROSCOPY (PCM)	Yes	No	Comments
5.1 Does the laboratory perform PCM analyses on samples received from the Libby Superfund site? ***If answered "No" precede to Section 6.0 of the checklist.***	☐	☒	
5.2 Is the PCM area adequate, clean, and orderly?	☐	☐	
5.3 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	☐	☐	

Personnel Interviewed

Name	Title	Experience

5.4 Methods and Guidance Documents	Yes	No	Comments
5.4.1 Are the applicable guidance documents available for reference:			
5.4.1.1 NIOSH Method 7400 (Issue 2), 1994?	NA	NA	
5.4.1.2 Other (list)?	NA	NA	
5.4.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
5.4.2.1 Laboratory Modification LB-000015A?	NA	NA	
5.4.2.2 SOP EPA-Libby-08?	NA	NA	
5.4.2.3 SAP Analytical Summaries?	NA	NA	
5.4.2.4 Project-specific Electronic Data Deliverables (EDDs)?	NA	NA	
5.4.2.5 Other (list)?	NA	NA	
5.5 Equipment			
5.5.1 Ventilation Hoods:			
5.5.1.1 Checked routinely and recorded in a permanent logbook?	NA	NA	
5.5.2 Are the microscopes used to analyze samples equipped with the following:			
5.5.2.1 Positive phase contrast, with green or blue filter?	NA	NA	
5.5.2.2 Adjustable field iris?	NA	NA	
5.5.2.3 Eyepiece (8 to 10X)?	NA	NA	
5.5.2.4 Phase magnification (40 to 45X)?	NA	NA	
5.5.2.5 Walton-Beckett Graticule?	NA	NA	
5.5.2.6 Stage micrometer with 0.01 mm subdivisions?	NA	NA	
5.5.3 Are microscope and phase ring alignment checks conducted daily?	NA	NA	
5.5.4 Is resolution periodically checked using an HSE/NPL slide?	NA	NA	
5.5.5 Are maintenance and calibration activities recorded in microscope-specific logbooks?	NA	NA	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

5.0 PHASE CONTRAST MICROSCOPY (PCM)	Yes	No	Comments
5.6 Sample Preparation			
5.6.1 Are filters prepared as described in the applicable method(s)?	NA	NA	
5.6.2 Are filters visibly overloaded (>25%) or contain loose debris prepared indirectly as described in SOP EPA-Libby-08?	NA	NA	
5.7 Sample Analysis			
5.7.1 Are the appropriate counting rules used (A or B)?	NA	NA	
5.7.2 How are the fields and fibers tracked and recorded?			
5.8 Quality Control			
5.8.1 Is each analyst provided a minimum of one reference slide per work day?	NA	NA	
5.8.2 Are recounts analyzed at a frequency of 1 per 10 samples analyzed?	NA	NA	
5.8.2.1 For count pairs not within acceptance limits are associated samples recounted?	NA	NA	
5.9 Standard Operating Procedures (SOPs)			
5.9.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	NA	NA	

Document Title	Control No.	Description

5.10 Document Control	Yes	No	Comments
5.10.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	NA	NA	

Document Title	Description/Comments

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.1 Are the grid preparation areas adequate, clean, and orderly?	☒	☐	
6.2 Are bulk samples prepared in an area separate from that used to prepare air and dust samples?	☒	☐	
6.3 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	☒	☐	

Personnel Interviewed

Name	Title	Experience
Matt Preston	Sample Preparation Technician	4 Years

6.4 Equipment & Supplies	Yes	No	Comments
6.4.1 Ventilation Hoods:			
6.4.1.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
6.4.2 Drying oven:			
6.4.2.1 Checked routinely and recorded in a permanent logbook?	NA	NA	
Note: Desiccator is an option for indirect preparation.			
6.4.3 Muffle furnace:			
6.4.3.1 Checked routinely and recorded in a permanent logbook?	NA	NA	
6.4.4 Analytical balances:			
6.4.4.1 Checked routinely and recorded in a permanent logbook?	NA	NA	
6.4.4.2 Calibrated within the last 12 months by a certified technician?	NA	NA	
6.4.5 Plasma Asher:			
6.4.5.1 Calibrated at least quarterly and recorded in a permanent logbook?	NA	NA	
Refer to Request for Modification LB-000085A			
6.4.6 Sputter Coater (Vacuum evaporator):			
6.4.6.1 Checked routinely and recorded in a permanent logbook?	NA	NA	
6.4.7 Filtration Apparatus (for indirect preparation):			
6.4.7.1 Are disposable or glass funnels used (record catalogue #)?	☒	☐	25mm Environmental Express (catalogue #F1500).
6.4.7.2 Has the Effective Filtration Area (EFA) been determined and recorded for each apparatus?	☒	☐	
6.4.8 TEM Grids:			
6.4.8.1 Is documentation for average grid opening determination available?	☒	☐	

Additional Comments:

LIBBY-SPECIFIC ASBESTOS LABORATORY ON-SITE AUDIT CHECKLIST

USEPA Date(s) of On-site: 05/09/2013

6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.5 Direct and Indirect Preparation Methodology			
6.5.1 What method(s) does the laboratory use to prepare air and dust samples for TEM analysis:			
6.5.1.1 40 CFR, Chapter 1, Part 763, Subpart E - AHERA?	☒	☐	
6.5.1.2 ISO 10312:1195 E - Determination of Asbestos Fibers?	☒	☐	
6.5.1.3 ASTM D 5755-09 - Micro vacuum Sampling and Indirect Analysis of Dust by TEM?	☒	☐	
6.5.1.4 Others (list)?	☐	☒	
6.5.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
6.5.2.1 Laboratory Modifications?	☒	☐	Available in eRoom
6.5.2.2 Project-specific SOPs?	☒	☐	
6.5.2.3 SAP Analytical Summaries?	☒	☐	
6.5.2.4 Other (list)?	☐	☒	
6.6 Sample Inspection			
6.6.1 Are air filter cassettes carefully wet-wiped prior to being transferred to the clean preparation area for inspection?	☒	☐	
6.6.2 Are air filter samples which are visibly overloaded, exhibit uneven loading, or contain loose debris, prepared indirectly? *Refer to Laboratory Modifications LB-000016H & LB-000031G*	☒	☐	
6.6.3 Are all ambient air samples dried upon receipt at the on-site laboratory (i.e., EMSL-Libby) prior to preparation and analysis? *Refer to Laboratory Modification LB-000055A*	☐	☒	Currently performed in Libby.
6.7 Direct Preparation of MCE and Polycarbonate Filters			
6.7.1 Are MCE filters collapsed using either a Di-Methyl Formamide (DMF) or acetone atmosphere (AA) technique (describe technique)? *The use of an acetone vaporizer ("hot block") is not advised due to the formation of wind rows and tilted fibers.*	☒	☐	Acetone "Hot Block" is used.
6.7.2 Is plasma etching performed on collapsed MCE filters?	☒	☐	
6.7.2.1 Is a 5 to10% layer of the collapsed surface removed during etching?	☒	☐	10 ± 1% is etched.
6.7.3 Are collapsed MCE filters and secured polycarbonate filters transferred to a vacuum evaporator for carbon coating?	☒	☐	
6.7.4 Are excised filter sections placed on the appropriately labeled TEM grids and cleared using a Jaffe Washer or an equivalent technique (describe)?	☒	☐	A condensation washer is used.
6.7.5 Are samples checked for remaining filter residue after clearing?	☒	☐	
6.7.5.1 If residue remains, is condensation washing or an equivalent technique used (describe technique)?	☒	☐	Extend clearing time.
Additional Comments:			

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.8 Indirect Sample Preparation of Air and Dust Samples			
6.8.1 Are the applicable Libby guidance documents available for reference:			
6.8.1.1 SOP EPA-Libby-08 – Indirect Preparation of Air and Dust Sample for TEM Analysis?	☒	☐	
6.8.2 Sample filtration:			
6.8.3 Are the applicable SAP Analytical Summaries reviewed to determine the whether or not filter samples must be ashed?	☒	☐	
6.8.3.1 Are cassettes examined for loose material?	☒	☐	
6.8.3.1.1 If loose material or uneven loading is not evident, is a portion of the air samples retained?	☒	☐	
6.8.3.1.2 If loose material is evident, is the loose material filtered along with the air filter?	☒	☐	
6.8.3.2 Ashing (if applicable):			
6.8.3.2.1 Are filters covered with aluminum foil and placed in a plasma asher?	☒	☐	
6.8.3.2.2 Is the plasma asher operated at minimum power?	☒	☐	
6.8.3.2.3 Is 100% ashing confirmed by visual observation?	☒	☐	6-8 hours.
6.8.3.3 Are air filters, loose material, dust, or ash, rinsed into a beaker and brought to a final volume of 100 mL with particle-free water?	☒	☐	
6.8.3.3.1 Adjusted to a pH of 3-4 with a 10% solution of glacial acetic acid?	☒	☐	
6.8.3.3.2 Sonicated for 3 minutes and allowed to settle for 2 minutes prior to filtering?	☒	☐	
6.8.3.4 Are the appropriate aliquots of filtrate passed through a disposable 25 mm filter assembly with a 0.2 µm MCE filter with a 5.0 µm MCE support pad?	☒	☐	
6.8.4 Are serial dilutions performed as necessary?	☒	☐	
6.8.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.9 Water Sample Preparation			
6.9.1 What method(s) does the laboratory use to prepare water samples for TEM analysis:			
6.9.1.1 EPA Method 100.2 - Determination of Asbestos Structures Over 10 µm in Length in Drinking Water?	☒	☐	
6.9.1.2 EPA Method 100.1 - Determination of Asbestos Fibers Drinking Water?	☒	☐	
6.9.1.3 Others (describe)? _____	☐	☒	
6.9.2 Are samples received and filtered by the laboratory within 48 hours of collection?	☒	☐	
6.9.2.1 If not, are they stored in a refrigerator until filtered?	NA	NA	Always filtered.
6.9.3 Laboratory Modification LB-000020A:			
6.9.3.1 Do samples undergo treatment with ozone/UV light?	☐	☒	Ozone/UV light equipment are not available, and samples would need to be treated and filtered in Libby, MT.
6.9.3.2 Are samples hand-agitated and sonicated?	☒	☐	
Refer to Section 6.2 of EPA Method 100.1			
6.9.4 Are the appropriate aliquots of the original sample poured though a 25 mm or 47 mm MCE filter (0.22 µm or smaller pore size) with an MCE filter (5 µm pore size) backing pad?	NA	NA	
Note: No less than 1 mL must be used as an aliquot.			
6.9.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.10 OU3 Tree Bark Sample Preparation			
6.10.1 Are the applicable Libby guidance documents available for reference:			
6.10.1.1 EPA-Libby-2012-12 – Sampling and Analysis of Tree Bark for Asbestos?	☒	☐	
6.10.2 Drying and Ashing:			
6.10.2.1 Are the diameter and thickness of the tree bark samples measured and recorded to an accuracy of ± 2mm?	☒	☐	
6.10.2.2 Is the entire tree bark sample weighed and placed in an oven for drying?	☒	☐	
6.10.2.2.1 Dried at 80º C until the weight stabilizes, a minimum of 6 hours, and weighed?	☒	☐	
6.10.2.3 Is the bark sample then covered and placed in a muffle furnace at 450º C for 18 hours, or until all organic matter has been removed, and weighed?	☒	☐	
6.10.2.3.1 Is the furnace ramped from 0º F to 450º C?	☒	☐	
6.10.3 Acid Treatment:			
6.10.3.1 After adding approximately 1-2 mL of DI water, is 10-20 of concentrated HCL added until no further reaction is visible (approx. 3-5 minutes)?	☒	☐	
6.10.3.2 Are samples diluted, transferred to a 100 mL container (with lid) and brought to a final volume of 100 mL with fiber-free DI water?	☒	☐	
6.10.3.3 Are samples capped, inverted 5-6 times, and sonicated for 2 minutes in preparation for filtering?	☒	☐	
6.10.4 Filtration:			
6.10.4.1 Are 5-20 mLs of solution transferred to a second container and brought to a volume of 100 mL with fiber-free DI water?	☒	☐	
6.10.4.2 Are dilutions agitated (inverted 5-6 times) and filtered through a 47 mm MCE filter (0.45 µm pore size)?	☒	☐	
6.10.4.2.1 Are additional dilutions prepared if the loading on the filter appears either too heavy (> 20%) or too light?	☒	☐	
6.10.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.11 OU3 Duff Sample Preparation			
6.11.1 Are the applicable Libby guidance documents available for reference:			
6.11.1.1 EPA-Libby-2012-11 – Sampling and Analysis of Duff for Asbestos?	☒	☐	
6.11.2 Drying and Ashing:			
6.11.2.1 Are the appropriate number of aluminum trays weighed and tared?	☒	☐	
6.11.2.1.1 For tracking purposes, is each tray marked with a unique number?	☒	☐	
6.11.2.2 Are trays filled to approximately ¾, dried at 60º C until the weight stabilizes a minimum of 10 hours, and weighed?	☒	☐	
6.11.2.3 Are dried duff samples transferred to covered pans and placed in a muffle furnace at 450º C for 18 hours, or until all organic matter has been removed, and weighed?	☒	☐	Refer to Finding No. 1 of the Audit Report.
6.11.2.4 Are ashed samples transferred to Zip-lock bags and homogenized?	☐	☒	
6.11.2.4.1 If an individual sample was split between multiple trays, was it combined into one Zip-lock bag?	☐	☒	
6.11.3 Acid Treatment:			
6.11.3.1 After adding approximately 1-2 mL of DI water to 0.25 grams (measured to ± 0.01 g) of ashed sample, is 10-20 mL of concentrated HCL added until no further reaction is visible (approx. 3-5 minutes)?	☒	☐	
6.11.3.2 Are samples diluted, transferred to a 100 mL container (with lid) and brought to a final volume of 100 mL with fiber-free DI water?	☒	☐	
6.11.3.3 Are sample capped, inverted 5-6 times, and sonicated for 2 minutes in preparation for filtering?	☒	☐	
6.11.4 Filtration:			
6.11.4.1 Is 0.1 to 1.0 mL of solution transferred to a second container and brought to a volume of 100 mL with fiber-free DI water?	☒	☐	
6.11.4.2 Are dilutions agitated (inverted 5-6 times) and filtered through a 47 mm MCE filter (0.45 µm pore size)?	☒	☐	
6.11.4.2.1 Are additional dilutions prepared if the loading on the filter appears either too heavy (> 20%) or too light?	☒	☐	
6.11.5 Are TEM grids prepared as described in Section 6.7 of this checklist?	☒	☐	

Additional Comments:

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6.0 TRANSMISSION ELECTRON MICROSCOPY (TEM) GRID PREPARATION	Yes	No	Comments
6.12 Grid Preparation/filtrate Storage			
6.12.1 For indirect preparations, are remaining filtrates filtered onto the appropriate filter(s) to be archived?	☒	☐	
6.12.2 Are all remaining filters and filter portions labeled prior to archiving?	☒	☐	
6.12.3 Are grids stored in marked grid storage boxes or other suitable containers and stored in a dust/fiber free environment?	☒	☐	Stored in capsules.
6.12.4 Is the location of grid preparation recorded in such a manner that they can be retrieved upon request in a timely manner?	☒	☐	Logbook available.
6.13 Quality Control Samples			
6.13.1 Are quality control samples prepared at the described frequency:			
6.13.1.1 Are laboratory blanks (LB) prepared at a frequency of 4% or with each preparation batch, whichever is more frequent?	☒	☐	
6.13.1.2 Are re-preparations prepared at a frequency of 1%?	☒	☐	
6.14 Standard Operating Procedures (SOPs)			
6.14.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	☐	☒	Refer to Finding No. 1 of the Audit Report.

Document Title	Control No.	Description

6.15 Document Control	Yes	No	Comments
6.15.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	☒	☐	

Document Title	Description/Comments

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.1 Are TEM areas adequate, clean, and orderly?	NA	NA	
7.2 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	NA	NA	

Personnel Interviewed

Name	Title	Experience

7.3 Methods and Guidance Documents	Yes	No	Comments
7.3.1 What method(s) does the laboratory use to analyze samples TEM:			
7.3.1.1 40 CFR, Chapter 1, Part 763, Subpart E (AHERA)?	NA	NA	
7.3.1.2 ISO 10312:1995 E - Determination of Asbestos Fibers?	NA	NA	
7.3.1.3 ASTM D 5755-09 - Microvacuum Sampling and Indirect Analysis of Dust by TEM?	NA	NA	
7.3.1.4 EPA Method 100.2 - Determination of Asbestos Structures Over 10 µm in Length in Drinking Water?	NA	NA	
7.3.1.5 Others (list)? _____	NA	NA	
7.3.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
7.3.2.1 Laboratory Modifications?	NA	NA	
7.3.2.2 Project-specific SOPs?	NA	NA	
7.3.2.3 SAP Analytical Summaries?	NA	NA	
7.3.2.4 Project-specific Electronic Data Deliverables (EDDs)?	NA	NA	
7.3.2.5 Other (list)? _____	NA	NA	
7.4 TEM Instrumentation			
7.4.1 Does TEM instrumentation meet the following requirements:			
7.4.1.1 Capable of being operated at between 80 and 120 kV?	NA	NA	
7.4.1.2 Electron diffraction (ED) and energy dispersive X-ray (EDX) capabilities?	NA	NA	
7.4.1.3 Fluorescent screen with an inscribed or overlaid calibrated scale?	NA	NA	
7.4.2 Are the instruments equipped with thin film or beryllium windows (list below if necessary)? Beryllium	NA	NA	
7.4.3 Are all routine and non-routine maintenance activities recorded in instrument-specific logbooks?	NA	NA	

Instrument No.	Make	Model	Capabilities
South	JEOL	JEM-100X	
North	JEOL	JEM-100X	

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.5 Instrument Calibration (Laboratory Modification LB-00085A)			
7.5.1 Is microscope alignment performed daily:			
7.5.1.1 Centering of electron beam?	NA	NA	
7.5.1.2 Electron beam is properly stigmated on either side of crossover?	NA	NA	
7.5.1.3 Image properly focused?	NA	NA	
7.5.2 Is the TEM screen magnification calibrated monthly?	NA	NA	
7.5.3 Is the camera constant calibrated monthly?	NA	NA	
7.5.4 Is the spot size diameter determined to be less than 250 nm quarterly?	NA	NA	
7.5.5 Is the low beam dose (>= 15 seconds for Chrysotile) verified quarterly?	NA	NA	
7.5.6 EDXA System:			
7.5.6.1 Is X-ray energy versus channel for two peaks (i.e., Cu/Al) checked daily?	NA	NA	
7.5.6.2 Is detector resolution (Mn) checked quarterly?	NA	NA	
7.5.6.3 Are K-factors relative to Si determined for Na, Mg, Al, Ca, and Fe quarterly?	NA	NA	
7.5.7 Are instrument calibration records maintained in instrument-specific logbooks?	NA	NA	
7.6 Reference Materials			
7.6.1 Does the laboratory maintain a library of reference materials on asbestos and other fiber types?	NA	NA	
7.6.2 Are instrument-specific “LA” spectra available, posted near the TEM?	NA	NA	
7.7 Grid Acceptance/Rejection Criteria			
7.7.1 Grid preparation rejection criteria:			
7.7.1.1 The replica is too dark due to poor dissolution?	NA	NA	
7.7.1.2 Replica is doubled or folded?	NA	NA	
7.7.1.3 Replica has > 25% obscuration rejected?	NA	NA	
7.7.1.4 Replica has < 50 intact grid openings?	NA	NA	
Refer to Request for Modifications LB-000016H and LB-000031G			
7.7.2 Are samples associated with grids determined to be overloaded (>25%) re-prepped using the indirect-transfer technique described in SOP EPA-Libby-08?	NA	NA	

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.8 Modifications to AHERA & ASTM D5755:			
7.8.1 Laboratory Modification LB-000031G:			
7.8.1.1 Are structures classified as fibers (F), bundles (B), clusters (C) or matrices (M)?	NA	NA	
7.8.1.2 Are the actual lengths and widths of fibers, bundles, clusters and matrices (M) recorded?	NA	NA	
7.8.1.3 For disperse matrices and clusters, is the length of the longest protruding structure recorded?	NA	NA	
7.8.1.4 Unless identified as a “close call” (LB-000066D), are NAMs not recorded?	NA	NA	
7.8.1.5 Is the designation “ND” used to document when no structures are detected in a grid opening?	NA	NA	
7.8.1.6 Are fibers, bundles, clusters and matrices only recorded they contain individual constituent fibers meeting the aspect ratio criterion?	NA	NA	
7.8.1.7 Are non-countable recorded, but not counted, for informational purposes?	NA	NA	
7.8.1.8 Is the entire length recorded for structures originating in one grid opening and extending to an adjacent grid opening?	NA	NA	
7.8.2 Laboratory Modification LB-000067:			
7.8.2.1 Are the structure identification codes described in Tables D.1 and D.2 of ISO Method 10312 used?	NA	NA	
7.9 Modifications to EPA Method 100.2:			
7.9.1 Laboratory Modification LB-000020:			
7.9.1.1 Are all applicable analyte structures, including those comprising the LA complex, ≥ 0.5 µ in length with a ≥ AR recorded?	NA	NA	
7.9.1.2 Are a maximum of 10 grid openings counted?	NA	NA	
7.9.2 Laboratory Modification LB-000067:			
7.9.2.1 Are the structure identification codes described in Tables D.1 and D.2 of ISO Method 10312 used?	NA	NA	

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.10 Modifications to ISO Method 10312:			
7.10.1 Laboratory Modification LB-000016H:			
7.10.1.1 Unless identified as a "close call" (LB-000066D), are NAMs recorded?	NA	NA	
7.10.1.2 Are bundles only recorded if they contain individual constituent fibers meeting the aspect ratio criterion?	NA	NA	
7.10.1.3 Are bundles, compact clusters, and compact matrices counted regardless of aspect ratio?	NA	NA	
7.10.1.4 Are structures that intersect non-countable grid bars recorded for informational purposes?	NA	NA	
7.10.1.5 Are component structures, which do not intersect non-countable grid bars, but are within non-countable structures counted?	NA	NA	
7.10.1.6 Is the entire length recorded for structures originating in one grid opening and extending to an adjacent grid opening?	NA	NA	
7.10.1.7 For structures which intersect more than one grid bar is the observed length of the structure recorded?	NA	NA	
7.10.1.8 Are the recorded rules for partially obscured structures properly applied (i.e., MFO and MBO)?	NA	NA	
7.10.1.9 Are the counting and recording rules for the identification of PCMe structures at "low magnification" applied?	NA	NA	
7.11 Common TEM Modifications:			
7.11.1 Laboratory Modification LB-000030:			
7.11.1.1 Are highly detailed sketches of up to 50 asbestos structures provided?	NA	NA	
7.11.2 Laboratory Modification LB-000066D:			
7.11.2.1 Is the presence or absence of sodium and potassium recorded for all LA, OA and NAM particles (NaK, NaX, XK or XX)?	NA	NA	
7.11.2.2 Is probable mineral identification code recorded for all particles?	NA	NA	
7.11.2.2.1 Are LA particles identified as WRTA, AC, TR or AT?	NA	NA	
7.11.2.2.2 Are OA particles identified as AM, AN or CR?	NA	NA	
7.11.2.2.3 Are NAMs indicated as PY, OT or UN?	NA	NA	
7.11.2.3 Is one SAED pattern recorded for each amphibole asbestos type encountered per samples?	NA	NA	
7.11.2.4 Are EDS spectrum (a maximum of 5) collected for up to 5 LA and 5 Close-call NAM per sample?	NA	NA	

Additional Comments:

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7.0 TEM ANALYSIS	Yes	No	Comments
7.12 Counting/stopping rules:			
7.12.1 Are the Analytical Summaries reviewed to determine the following:			
7.12.1.1 Analytical Sensitivity?	NA	NA	
7.12.1.2 Recording rules (i.e., AR)?	NA	NA	
7.12.1.3 Stopping rules (i.e., abundant CH)?	NA	NA	
7.12.1.4 Applicable Laboratory Modifications?	NA	NA	
7.12.1.5 Investigative or non-investigative?	NA	NA	
7.13 Quality Control Analyses (Laboratory Modification LB-000029C)			
7.13.1 Are quality control samples analyzed at the required frequencies:			
7.13.1.1 Laboratory blanks – Frequency 4%?	NA	NA	
7.13.1.2 Recount Same (RS) - Frequency of 1%?	NA	NA	
7.13.1.3 Recount Different (RD) - Frequency of 2.5%?	NA	NA	
7.13.1.4 Inter-laboratory - Frequency of 0.5%?	NA	NA	
7.13.1.5 Verified Analysis (VA) - Frequency of 1%?	NA	NA	
7.13.1.6 Re-preparations – Frequency of 1%	NA	NA	
7.13.2 Are samples selected for RS, RD and VA analyses in accordance with Laboratory Modification LB-000029C?	NA	NA	
7.13.3 Is the procedure used to evaluate QC sample analyses in accordance with Laboratory Modification LB-000029C?	NA	NA	
7.14 Standard Operating Procedures (SOPs)			
7.14.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	NA	NA	

Document Title	Control No.	Description

7.15 Document Control	Yes	No	Comments
7.15.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	NA	NA	

Document Title	Description/Comments

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.1 Are PLM areas adequate, clean, and orderly?	☒	☐	
8.2 Are steps taken to prevent the cross-contamination of equipment, supplies, and reagents?	☒	☐	
Personnel Interviewed			

Name	Title	Experience
Wenlong Lia	PLM Analyst	21 Years

8.3 Methods and Guidance Documents	Yes	No	Comments
8.3.1 Are the applicable guidance documents available for reference:			
8.3.1.1 EPA SOP SRC-Libby-01?	☒	☐	
8.3.1.2 EPA SOP SRC-Libby-03?	☒	☐	
8.3.1.3 NIOSH 9002, Issue 2 - Asbestos (Bulk) by PLM?	☒	☐	
8.3.1.4 Others (list)?	☐	☒	
8.3.2 Are project-specific requirements communicated to laboratory personnel and available for reference:			
8.3.2.1 Laboratory Modifications?	☒	☐	Available in eRoom
8.3.2.2 Project-specific SOPs?	☒	☐	
8.3.2.3 SAP Analytical Summaries?	☒	☐	
8.3.2.4 Project-specific Electronic Data Deliverables (EDDs)?	☒	☐	
8.3.2.5 Other (list)?	☐	☒	
8.4 Equipment			
8.4.1 Ventilation Hoods:			
8.4.1.1 Checked routinely and recorded in a permanent logbook?	☒	☐	
8.4.2 Drying oven (optional):			
8.4.2.1 Checked routinely and recorded in a permanent logbook?	☐	☒	Muffle furnace calibrated to low temperature.
8.4.3 Muffle furnace:			
8.4.3.1 Checked routinely and recorded in a permanent logbook?	☒	☐	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.4.4 Analytical balances:			
8.4.4.1 Two balances:			
8.4.4.1.1 Accurate to 0.01 g, range of 0.01 to 1000 g?	☐	☒	Not necessary, SOP
8.4.4.1.2 Accurate to 1 mg?	☒	☐	SRC-Libby-01 to be revised.
8.4.4.2 Checked routinely and recorded in a permanent logbook?	☒	☐	
8.4.4.3 Calibrated within the last 12 months by a certified technician?	☒	☐	
8.5 Stereomicroscope			
8.5.1 Do stereomicroscopes meet the following requirements:			
8.5.1.1 Magnification range of 10X to 50X?	☒	☐	
8.5.1.2 Incandescent or fluorescent light source?	☒	☐	
8.6 Polarized Light Microscope			
8.6.1 Are PLMs equipped with the following:			
8.6.1.1 Light source and replacement bulbs?	☒	☐	
8.6.1.2 Binocular observation tube?	☒	☐	
8.6.1.3 Blue daylight filter?	☒	☐	
8.6.1.4 Oculars (10X)?	☒	☐	
8.6.1.5 Objectives: 10X, 20X and 40X (or similar)?	☒	☐	
8.6.1.6 10X dispersion staining objective?	☒	☐	
8.6.1.7 A 360 degree graduated rotating stage?	☒	☐	
8.6.1.8 Polarizer and analyzer aligned at 90 degrees to one another?	☒	☐	
8.6.1.9 Bertrand lens?	☒	☐	
8.6.1.10 Substage condenser with iris diaphragm?	☒	☐	
8.6.1.11 Accessory slot for compensator plate?	☒	☐	
8.6.1.12 First order red (550 nanometer) compensator plate?	☒	☐	
8.6.1.13 Crosshair reticle?	☒	☐	
8.6.1.14 Adjustment tools?	☒	☐	
8.6.2 Are microscopes well-maintained, and are all routine and non-routine maintenance activities recorded in instrument-specific logbooks?	☒	☐	

Instrument No.	Make	Model	Capabilities
Station 1	Olympus	BH-2	Standard
Station 2	Wild	M3Z	Standard
Station 3	Wild	M3Z	Standard
Station 4	Zeiss	47 30 59	Standard
Station 5	Wild	M3Z	Standard
Station 6	Leica	S6D	Standard
Station 7	Nikon	Labphot POL	Standard

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.7 Refractive Index Liquids			
8.7.1 What refractive index liquids are available:			
8.7.1.1 High dispersion RI liquids from 1.620 to 1.640?	☒	☐	
8.7.1.2 1.550 high dispersion RI liquid?	☒	☐	
8.7.1.3 1.680 to 1.700 RI liquids?	☒	☐	
8.7.2 Are refractive index liquids checked daily for contamination?	☒	☐	Yes, with fiberglass
8.7.3 Are refractive index (RI) liquids calibrated monthly using a refractometer or other means (describe)?	☒	☐	
8.8 Reference Materials			
8.8.1 Does the laboratory maintain a library of asbestos and non-asbestos reference materials:			
8.8.1.1 NIST SRM 1866b (Ch, Am and Cr)?	☒	☐	
8.8.1.2 NIST SRM 1867a (Tr, Ac, and An)?	☒	☐	
8.8.1.3 USGS LA PEs:	☒	☐	
8.8.1.3.1 LA 0.2% by mass?	☒	☐	
8.8.1.3.2 LA 1.0% by mass?	☒	☐	
8.8.1.3.3 Other (List)?	☒	☐	2% and 0.5 % LA.
8.8.1.4 Controlled LA asbestos (USGS)?	☒	☐	
8.8.1.5 NIST testing round M12001 (winchite/richterite)?	☒	☐	
8.8.1.6 Non-asbestos (i.e., gypsum, calcite, and fiberglass)?	☒	☐	
8.9 PLM Calibration	**Yes**	**No**	**Comments**
8.9.1 Is PLM alignment performed daily:			
8.9.1.1 Alignment?	☒	☐	
8.9.1.2 Stage and objectives centered?	☒	☐	
8.9.1.3 Optic axis centered?	☒	☐	
8.9.1.4 Alignment of the upper/lower polars?	☒	☐	
8.9.1.5 Centered through substage condenser and iris diaphragm?	☒	☐	
8.9.2 Microscope adjustments verified and recorded prior to sample analyses?	☒	☐	Recorded on individual bench sheets.

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.10 PLM Analysis by NIOSH Method 9002:			
8.10.1 Does the laboratory perform PLM analyses on samples received from the Libby Superfund site? ***If answered "No" precede to Section 8.11 of the checklist.***	☐	☒	
8.10.2 Are samples visually examined by stereomicroscope for the following: 8.10.2.1 Color? 8.10.2.2 Homogeneity? 8.10.2.3 Texture?	 ☐ ☐ ☐	 ☐ ☐ ☐	
8.10.3 Which of the following techniques are used to prepare samples for analysis: 8.10.3.1 Mortar & pestle? 8.10.3.2 Acid washing? 8.10.3.3 Ashing? 8.10.3.4 Solvents? 8.10.3.5 Other (list)?	 ☐ ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐ ☐	
8.10.4 For non-friable, organically bound samples requiring ashing and/or acid reduction, are all necessary weights and tare weights measured and recorded?	☐	☐	
8.10.5 Are slides prepared using the appropriate refractive index liquid(s) and scanned for asbestos fibers using the following optical properties: 8.10.5.1 Morphology? 8.10.5.2 Color? 8.10.5.3 Refractive indices? 8.10.5.4 Pleochroism? 8.10.5.5 Birefringence? 8.10.5.6 Extinction characteristics? 8.10.5.7 Sign of elongation? 8.10.5.8 Dispersion staining characteristics?	 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	
8.10.6 Are the observed optical properties compared to Table 1 (Optical Properties of Asbestos Fibers) to determine the asbestos mineral present?	☐	☐	
8.10.7 Is a quantitative assessment of asbestos content made from both the gross and microscopic examinations?	☐	☐	
8.10.8 If no fibers are detected in a homogeneous samples are at least two additional slides prepared and analyzed prior to concluding no asbestos is present?	☐	☐	
8.10.9 Is at least one optical property recorded for fibers determined to be non-asbestos fibers?	☐	☐	
Additional Comments:			

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.11 PLM-VE (SOP SRC-Libby-03)			
8.11.1 Stereomicroscopic Examination:			
8.11.1.1 Are all sample preparation activities performed within a HEPA-filtered hood?	☒	☐	
8.11.1.2 Is the entire sample transferred to an asbestos-free substrate for examination?	☒	☐	
8.11.1.3 Is the entire sample examined for homogeneity and the presence of suspect fibers?	☒	☐	
8.11.1.4 Are suspect fibers removed with fine forceps and mounted in the appropriate RI liquid for PLM analysis?	☒	☐	
8.11.1.5 Are the stereomicroscopic findings recorded:			
8.11.1.5.1 Sample appearance?	☒	☐	
8.11.1.5.2 Estimated percentage of LA?	☒	☐	
8.11.1.5.3 Estimated percentage of other asbestos types?	☒	☐	
8.11.2 Determination of Ashing the Sample:			
8.11.2.1 Are soil sample containing a significant amount of artifacts ashed prior to being prepared for random PLM mounts?	NA	NA	
8.11.2.1.1 Are samples ashed in a muffle furnace at approximately 480°C?	NA	NA	None observed to-date.
8.11.2.1.2 Are the necessary gravimetric measurements recorded for the determination of “Pre-ash percent asbestos”?	NA	NA	
8.11.3 Slide Preparation for PLM-VE:			
8.11.3.1 Are a minimum of five random sub-samples mounted in the appropriate RI liquid (1.620-1.640) for measurement of LA optical properties?	☒	☐	
8.11.4 Supplemental Stereomicroscopic Evaluation:			
8.11.4.1 Following the random slide mount preparation, is the container agitated to cause the particulate to settle and asbestos fibers sort to the surface?	☒	☐	
8.11.4.2 Is the sample re-examined and the fiber pick procedure repeated?	☒	☐	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.11.5 Classification of Asbestos Mineral Type:			
8.11.5.1 Using PLM is entire area of each prepared slide examined for asbestos, non-asbestos and matrix material?	☒	☐	
8.11.5.2 Is positive identification determined from the following six optical properties:			
8.11.5.2.1 Habit?	☒	☐	
8.11.5.2.2 Color & pleochroism (if present)?	☒	☐	
8.11.5.2.3 Both alpha and gamma Refractive indices?	☒	☐	
8.11.5.2.4 Birefringence?	☒	☐	
8.11.5.2.5 Extinction angle?	☒	☐	
8.11.5.2.6 Sign of elongation (positive-slow or negative fast)?	☒	☐	
8.11.5.3 Based on the optical properties, is asbestos classified into one of three categories:			
8.11.5.3.1 Libby Amphibole (LA)?	☒	☐	
8.11.5.3.2 Other Amphibole (OA)?	☒	☐	
8.11.5.3.3 Chrysotile (CH)?	☒	☐	
8.11.5.4 Is at least one optical property recorded for observed non-asbestos fibers?	☒	☐	
8.11.6 Quantification of Asbestos Content:			
8.11.6.1 Is asbestos reported as either mass or area percent for LA?	☒	☐	
8.11.6.2 Are other, non-LA, asbestos types reported in area percent?	☒	☐	
8.11.6.3 Are reference materials used to aid in visual estimation:			
8.11.6.3.1 LA PE reference materials (0.2% or 1.0%)?	☒	☐	
8.11.6.3.2 Are visual estimates of greater than 1% LA performed using calibration standards made in-house from NIST SRMs and NIST PEs?	☒	☐	
8.11.7 Are calibrated visual estimates determined from both the detailed stereomicroscopic observations and examination of the total area for all five random slide mounts?	☒	☐	
8.11.8 Are LA results reported in the appropriate bin categories:			
8.11.8.1 Non-detects recorded as Bin A?	☒	☐	
8.11.8.2 Less than 0.2% LA recorded as Bin B1?	☒	☐	
8.11.8.3 Greater than 0.2%, but less than 1% recorded as Bin B2?	☒	☐	
8.11.8.4 Equal to or greater than 1% recorded as Bin C, with the percentage recorded as a whole number?	☒	☐	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.12 PLM-GRAV (SOP SRC-Libby-01)			
8.12.1 Stereomicroscopic Examination:			
8.12.2 Is the entire sample weighed and placed in an appropriate container?	☒	☐	
8.12.3 Does the stereomicroscopic examination include:			
8.12.3.1 Examination of multiple fields of view over the entire sample?	☒	☐	
8.12.3.2 Probing of the sample and breaking clumps where possible?	☒	☐	
8.12.3.3 Manipulation of the sample with the appropriate tools?	☒	☐	
8.12.3.4 Observation homogeneity, texture, friability, color and extent of any asbestos content?	☒	☐	
8.12.4 Doe the analyst refrain from segregating and weighing particles smaller than 2 - 3 mm (1/10 inch)?	☒	☐	
8.12.5 If no particles larger than 2 – 3 mm or larger are present, are one of the following recorded:			
8.12.5.1 No asbestos detected (ND)?	☒	☐	
8.12.5.2 Trace levels of asbestos observed, but not quantified (Tr)?	☒	☐	
8.12.6 Examination by PLM:			
8.12.7 Are tentatively identified asbestos particles examined by PLM as described in SOP SRC-Libby-03 (Section 8.12 of this checklist)?	☒	☐	
8.12.8 If asbestos particles are determined to be OA, are they further characterized:			
8.12.8.1 Amosite (AMOS)?	☒	☐	
8.12.8.2 Anthophylite (ANTH)?	☒	☐	
8.12.8.3 Crocidolite (CROC)?	☒	☐	
8.12.8.4 Unknown (UNK)?	☒	☐	
8.12.9 Is the total weight of each type of positively identified asbestos measured and recorded?	☒	☐	
8.12.10 Record Keeping:			
8.12.11 Is the data log sheet provided in Attachment 1 of the SOP used to record weights the initial (coarse fraction) and segregated asbestos?	☒	☐	

Additional Comments:

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8.0 POLARIZED LIGHT MICROSCOPY (PLM)	Yes	No	Comments
8.13 Quality Control Analyses			
8.13.1 Are the following types of QC analyses performed at the required frequencies:			
8.13.1.1 Laboratory duplicate self-check (LDS) at a frequency of 2%?	☒	☐	
8.13.1.2 Laboratory duplicate cross-check (LDC) at a frequency of 8%?	☒	☐	
8.13.2 For sample containing LA, are LDS and LDC analyses considered acceptable if:			
8.13.2.1 For LA results, within 1 Bin category?	☒	☐	
8.13.2.2 For LA results, %LA ≤1%?	☒	☐	
Note: For LA results greater than 1%, the laboratory should refer to their internal QA/QC system.			
8.13.3 Is the appropriate correction action taken when LDC or LDS analyses do not meet acceptance criteria (describe)?	☒	☐	
8.14 Standard Operating Procedures (SOPs)			
8.14.1 Are the applicable laboratory SOPs available and followed by laboratory personnel (list)?	☒	☐	

Document Title	Control No.	Description
SRC-LIBBY-01	Revision 3	
SRC-LIBBY-03	Revision 3	
SOP for PLM	January 1, 2012	

8.15 Document Control	Yes	No	Comments
8.15.1 Are all logbooks, notebooks, forms, or other laboratory documents legible, accurate, and complete (list)?	☒	☐	

Document Title	Description/Comments

Additional Comments:

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9.0 DATA MANAGEMENT	PCM	TEM	PLM	Comments
9.1 Data Package Review and Assembly	**Yes**	**Yes**	**Yes**	
9.1.1 Are deliverables reviewed to ensure project-specific requirements are adhered to:				
9.1.1.1 Request for Modifications to Laboratory Activities?	NA	☒	☒	
9.1.1.2 Project-specific SOPs?	NA	☒	☒	
9.1.1.3 SAP Analytical Summaries?	NA	☒	☒	
9.1.1.4 Project-specific Electronic Data Deliverables (EDDs)?	NA	☒	☒	
9.1.1.5 Other (list)? _____	NA	☒	☒	
9.1.2 Are all deliverables reviewed for completeness and accuracy prior to being submitted:				
9.1.2.1 Hard copy deliverables?	NA	☒	☒	
9.1.2.2 Electronic deliverables?	NA	☒	☒	
9.1.3 Are all reviews documented?	NA	☒	☒	
9.2 Data Submission				
9.2.1 Is the submittal of electronic deliverables tracked and recorded:				
9.2.1.1 Date submitted?	NA	☒	☒	
9.2.1.2 Recipient?	NA	☒	☒	
9.2.2 Is the submittal of hard copy deliverables tracked and recorded:				
9.2.2.1 Date submitted?	NA	☒	☒	
9.2.2.2 Recipient?	NA	☒	☒	
9.3 Data Storage and Archiving				
9.2.3 Are electronic files archived onto suitable media on a frequent basis? How often? Daily back-up	NA	☒	☒	
9.2.4 Are all hardcopy data stored in a secured location with limited access (e.g., locking file cabinet)?	NA	☒	☒	

Additional Comments:

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10.0 QUALITY ASSURANCE/QUALITY CONTROL	PCM	TEM	PLM	Comments
10.1 Laboratory Certifications	**Yes**	**Yes**	**Yes**	
10.1.1 Is the laboratory accredited for asbestos analysis under the National Voluntary Laboratory Accreditation Program (NVLAP):				
10.1.1.1 Asbestos Fiber Analysis (TEM Method)?	NA	☒	NA	
10.1.1.2 Asbestos Fiber Analysis (PLM Method)?	NA	NA	☒	
10.1.2 Is the laboratory accredited for asbestos analysis under the American Industrial Hygiene Association (AIHA), and does it participate in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program?	NA	NA	NA	
10.2 Training				
10.2.1 Have all analysts undergone training on the proper usage of the equipment and instrumentation used in the respective areas?	NA	☒	☒	
10.2.2 Have all analysts demonstrated proficiency through the preparation and/or analysis of standards or samples of known values?	NA	☒	☒	
10.2.3 Are training records maintained in analyst-specific files?	NA	☒	☒	
10.3 Internal Audits				
10.3.1 Are internal audits conducted on an annual basis using an appropriate checklist?	NA	☒	☒	
10.3.1.1 Are internal audit reports available for review?	NA	☒	☒	
10.4 Corrective/Preventive Action:				
10.4.1 Can the laboratory demonstrate the sequence of problem identification, corrective action, and resumption of duties?	NA	☒	☒	
10.5 Quality Records				
10.5.1 Are SOPs available in the applicable areas for all laboratory-specific procedures?	NA	☒	☒	
10.5.2 Does the laboratory have a Quality Assurance Manual/Plan?	NA	☒	☒	
10.5.3 Does the laboratory compile monthly quality assurance/quality control reports?	NA	☒	☒	
10.6 Environmental Controls/Laboratory Monitoring				
10.6.1 Does the laboratory conduct an environmental monitoring program?	NA	☒	☒	
10.6.2 Is quarterly air monitoring performed in all laboratory areas?	NA	☒	☒	
10.6.2.1 Are the collected samples analyzed by TEM with a target analytical sensitivity of 0.005 structures/cc?	NA	☒	☒	
10.6.2.2 If LA is detected, are the affected areas thoroughly cleaned and a new set of samples collected and analyzed?	NA	☒	☒	
Laboratory Modification LB-000085A				
Additional Comments:				